United States Department of Agriculture
Agricultural Research Service

SOURCES OF RESISTANCE TO THE SWEETCLOVER APHID IN INTRODUCED SPECIES OF MELILOTUS 1/

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The possibility of locating sources of resistance to the sweetclover aphid (Therioaphis riehmi (Börner)) and of controlling this insect with resistant varieties of sweetclover has been discussed previously (3).2/ This report describes screening tests with introduced species of Melilotus3/ and evaluation of sweetclover aphid resistance in selections made from these species.

Methods

Screening was accomplished by planting the test species of Melilotus in rows in greenhouse flats. Each flat also contained two rows of a susceptible check--common biennial yellow sweetclover--and one row of a resistant check--N-13, a large-seeded strain previously shown to be the best source of resistance available (3). Several additional checks were planted in some flats. The plants were grown in a greenhouse section, where an uncaged culture of the aphids was maintained, so that the seedlings became infested shortly after emergence. The first stand count was made soon after plant emergence and a final count when most of the susceptible check plants had been killed by the aphids. Individual plants that appeared to be resistant were potted and held for further testing.

Further evaluation of the selected plants was made by confining three first- or second-instar nymphs on each plant. When the plants were examined at 3-day intervals, three additional nymphs were added if all the nymphs in the cage were dead. Aphid counts were made at the end of 2 1/2 weeks.

1/ Cooperative study with the Nebraska Agricultural Experiment Station. Published with the approval of the Director as Paper No. 1392, Journal Series, Nebraska Agricultural Experiment Station. Contribution No. 237 of the Department of Entomology, University of Nebraska, Lincoln.

2/ Numbers in parentheses refer to Literature Cited at the end of this report.

3/ Seed furnished through the courtesy of W. H. Skrdla, U.S.Department of Agriculture, Regional Plant Introduction Station, Ames, Iowa.

Selfed seed was obtained from each plant, and the seedling progeny were evaluated for resistance under conditions similar to those when the initial selections were made.

Results

None of the 98 accessions tested were uniformly resistant, but 26 of them appeared to contain one or more resistant plants. The performance of the individual accessions, when subjected to mass aphid infestation, is given in tables 1 and 2. The following accessions had survival rates approaching or exceeding that of the resistant check N-13: P.I. 31647, 204898, 228351 of M. officinalis, P.I. 52916, 187005, 202041 of M. alba, and P.I. 67512 of M taurica. However, aphid damage was severe, and few resistant plants were found in most of these accessions. Presumably the greater survival rates of these accessions resulted from increased seedling vigor or some other factor increasing tolerance to aphid attack. Because high levels of either antibiosis or nonpreference resistance were available, no selections were made for higher survival rates unless injury was greatly reduced.

It is evident that resistance was available in introductions from many different countries of the world, as shown in table 3. A high proportion of the selections were of Turkish origin, but the percentage of resistant plants in the Turkish accessions was not high, with the exception of P.I. 178985. The resistant check N-13 was previously selected, in mass, for large seed from P.I. 178985 and thus should have been equivalent to P.I. 178985 in resistance. Approximately half of the plants in the resistant check entries were resistant to the aphid. This is similar to the situation reported in the literature (1,2) concerning resistance to the spotted alfalfa aphid (Therioaphis maculata Buckton)) in alfalfa, where alfalfa varieties with Turkistan parentage have a higher proportion of resistant plants than most other varieties tested. In both alfalfa and sweetclover, sources of aphid resistance appear to be greatest in the geographical area of probable origin of the plant species.

In table 4, sources of resistance are considered in relation to species of Melilotus. Nearly one-third of the accessions of both M. officinalis and M. alba produced one or more resistant plants, but the 19 accessions of 9 additional species produced only 3 resistant selections. This is consistent with results of other workers (4), who reported much variation in aphid reaction within M. alba and M. officinalis.

Of the 51 plants selected, only 35 survived transplanting, and selfed-seed was produced on only 20. Results of the antibiosis and progeny tests on the selected plants are shown in table 5. Only selections 51 and II-11-2 appeared susceptible in the antibiosis test, indicating misidentification of resistance in the original selections. The former was not progeny tested and the latter produced all susceptible progeny. Selections 49, 134-1, and II-40-5 appeared resistant in the antibiosis test, but produced all susceptible progeny. Of the other 16 selections that were progeny tested, 2 had all resistant progeny whereas the remainder appeared to be segregating, confirming the heritability of aphid resistance in these selections.

Literature Cited

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Table 1.--Evaluation of sweetclover aphid resistance in various introductions of *Melilotus officinalis* and *M. alba*

Plant introduction No. (P.I.-)	Source of original seed	Plants evaluated	Survival	Resistant plants
M. officinalis:		Number	Percent	Number
31647	India	19	84	3
67511	Crimea	22	9	0
77464	Russia	18	11	0
88990	Manchuria	17	0	0
89596	China	21	33	0
89911	Spain	25	4	0
90035	do.	15	7	0
90037	do.	13	0	0
107085	Russia	15	33	3
108651	Ukraine	18	33	0
108653	do.	15	20	0
132269	Romania	19	42	0
172430	Turkey	18	50	0
172432	do.	16	44	0
172433	do.	20	40	4
172434	do.	8	12	1
172435	do.	11	9	0
172990	do.	12	0	0
172991	do.	16	12	1
173739	do.	14	14	0
178985	do.	6	67	4
184117	Yugoslavia	10	0	0
199260	Greece	12	17	0
174276	Turkey	7	43	0
178984	do.	17	18	0
204466	do.	8	0	0
204467	do.	15	27	0
204896	do.	9	55	0
204897	do.	11	45	0
204898	do.	7	86	0
204900	do.	9	67	0
204901	do.	16	25	0
204902	do.	16	25	0
205197	do.	7	57	1
205301	do.	12	33	0
205534	Canada	21	14	0
205536	do.	33	18	2
205537	India	18	0	0
205538	U.S.A. (Nebr.)	22	4	0
205539	U.S.A. (Iowa)	24	21	1
208073	Turkey	8	25	1
213327	Canada	18	33	3

Table 1 (continued)

213328	do.	31	39	1
213329	U.S.A. (Va.)	7	57	0
210368	Iran	4	0	0
213326	U.S.A. (W. Va.)	18	50	2
222114	Afghanistan	11	54	2
228288	Iran	7	4	0
228351	do.	13	69	1
229957	do.	8	0	0
230351	do.	4	50	1
230875	Yugoslavia	24	8	0
M. alba:				
52916	Spain	7	71	2
90031	do.	11	54	0
90186	Manchuria	17	2	0
90557	do.	20	5	0
165554	India	17	0	0
173740	Turkey	11	9	0
173741	do.	12	17	0
178983	do.	12	17	0
179372	do.	33	58	8
187005	U.S.A. (Iowa)	13	100	1
190278	Canada	8	0	0
193292	Yugoslavia	6	67	2
198965	Cyprus	13	23	0
200355	Israel	8	0	0
202040	Argentina	14	7	0
260753	Cyprus	17	0	0
202701	Uruguay	11	9	0
205299	Turkey	16	13	1
205300	do.	16	2	0
205302	do.	15	0	0
208684	Algeria	22	45	0
211611	Afghanistan	19	42	0
212247	Yugoslavia	10	40	1
213323	Afghanistan	10	10	0
202041	Argentina	11	73	1
202452	do.	13	0	0
206701	Turkey	20	45	1
Checks: 1/				
Common (S)		252	16	2
N-13 (R)		114	75	58
G-333 (R)		9	55	4
G-339 (R)		11	72	8
Denta (U)		66	32	1
Spanish (U)		29	79	6

1/ S=susceptible; R=resistant; U=unselected.

Table 2.--Evaluation of sweetclover aphid resistance in various introduced species of Melilotus

Plant introduction No. (P.I.-)	Species	Source of original seed	Plants evaluated	Survival	Resistant plants
			Number	Percent	Number
67510	M. taurica	Crimea	6	50	0
67512	M. taurica	do.	5	100	2
67854	M. taurica	Russia	11	54	0
90755	Melilotus sp.	China	12	0	0
116708	M. dentata	Russia	8	0	0
129697	M. hirsuta	Sweden	10	40	1
205532	M. dentata	U.S.A. (Wis.)	4	50	0
205533	M. dentata	U.S.A. (Wis.)	3	0	0
213324	M. dentata	Siberia (western)	10	10	0
226539	M. sulcata	Morocco	11	0	0
226681	M. segetalis	Portugal	1	0	0
227001	M. messanensis	Israel	22	0	0
227003	M. sulcata	Portugal	21	9	0
227004	M. segetalis	do.	13	8	0
227006	M. segetalis	do.	8	3	0
227005	M. segetalis	do.	13	8	0
227036	M. indica	Iran	11	0	0
227113	M. italica	Greece	14	0	0
227114	M. sulcata	do.	12	0	0
Checks: 1/					
Common (S)			15	0	0
N-13 (R)			34	68	12

1/ S=susceptible; R=resistant.

Table 3.--Summary, by countries of origin, of Melilotus introductions evaluated for sweetclover aphid resistance

Country of origin	Accessions evaluated	Accessions with resistant plants	Total resistant selections
	Number	Number	Number
Afghanistan	3	1	2
Algeria	1	0	0
Argentina	3	1	1
Canada	5	3	6
China	2	0	0
Crimea	3	1	2

Table 3 (continued)

Cyprus	2	0	0
Greece	3	0	0
India	3	1	3
Iran	6	2	2
Israel	2	0	0
Manchuria	3	0	0
Morocco	1	0	0
Portugal	5	0	0
Romania	1	0	0
Russia	4	1	3
Siberia (western)	1	0	0
Spain	5	1	2
Sweden	1	1	1
Turkey	30	9	22
Ukraine	2	0	0
U.S.A.	7	3	4
Uruguay	1	0	0
Yugoslavia	4	2	3
Total	98	26	51

Table 4.--Summary, by species of Melilotus, of introductions evaluated for sweetclover aphid resistance

Species	Accessions evaluated	Accessions with resistant plants	Total resistant selections
	Number	Number	Number
M. alba	27	8	17
M. dentata	4	0	0
M. hirsuta	1	1	1
M. indica	1	0	0
M. italica	1	0	0
M. messanensis	1	0	0
M. officinalis	52	16	31
M. segetalis	4	0	0
M. sulcata	3	0	0
M. taurica	3	1	2
Melilotus sp.	1	0	0
Total	98	26	51

Table 5.--Evaluation of sweetclover aphid resistance in selected plants and progeny from introduced species of Melilotus

Selection No.	Origin (P.I.-)	Antibiosis of selected plants			Plant progeny[1/]	
		Aphids introduced	Aphid survivors and progeny	Rating[1/]	Resistant	Susceptible
		Number	Number		Number	Number
2	205197	12	0	R	--	--
23	172991	12	0	R	--	--
26	172434	12	0	R	--	--
27-1	172433	9	0	R	--	--
27-2	172433	9	0	R	--	--
27-3	172433	9	0	R	--	--
27-4	172433	12	0	R	--	--
36	107085	12	0	R	24	7
49	230351	3	7	R	0	3
51	228351	3	15	S	--	--
56	222114	6	0	R	5	7
57	213326	12	0	R	6	1
61-1	213327	12	0	R	--	--
61-2	213327	12	6	R	8	1
62	208073	3	6	R	4	2
72	202041	12	0	R	30	0
92-2	193292	9	2	R	24	0
92-1	193292	12	0	R	3	1
94	187005	6	13	R	19	4
106-1	52916	12	0	R	15	10
106-2	52916	9	0	R	10	5
130	129697	12	0	R	10	6
134-1	67512	12	0	R	0	27
II-11-2	31647	3	33	S	0	9
II-14	212247	12	0	R	31	4
II-20	206701	12	0	R	--	--
II-23	205299	12	0	R	3	1
II-39	205536	12	0	R	6	3
II-40-1	179372	12	0	R	--	--
II-40-2	179372	12	0	R	--	--
II-40-3	179372	12	0	R	10	3
II-40-4	179372	12	0	R	--	--
II-40-5	179372	12	0	R	0	32
II-40-6	179372	12	0	R	--	--
II-40-7	179372	12	0	R	--	--
Checks:[2/]						
G-337-3 (R)		12	0	R	--	--
G-232-3-2 (R)		12	0	R	--	--
G-308 (S)		3	68	S	--	--
G-220-2 (S)		3	20	S	--	--
G-308 (S)		3	77	S	--	--
G-319 (S)		--	--	--	0	51
G-328 (R)		--	--	--	29	6

1/ Under conditions of mass infestation.
2/ R=resistant; S=susceptible.